

# **Health & Safety Manual**

## **Supplement 24.30**

### **Response Plan for Fire in an Explosives Area**

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**Approved by the ES&H Working Group**

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## **Response Plan for Fire in an Explosives Area\***

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# **Response Plan for Fire in an Explosives Area**

## **1.0 Introduction**

This supplement describes the Emergency Response Plan and procedures for fire fighters responding to fires in explosives areas. The primary objective of these procedures is to provide protective measures to minimize injury from the blast effects of overpressure and fragments, and burns from high thermal flux.

## **2.0 Applicability**

The guidance in this supplement applies to all operations at the Livermore site and Site 300 involving explosives and to individuals who perform such operations.

## **3.0 Requirements/Regulatory Summary**

The setback distance, withdrawal distance principles, facility placarding guidelines, and fire symbols specified in this supplement are taken from the Department of Defense (DOD) *Ammunition and Explosives Safety Standards* (DOD 6055.9 STD).

## **4.0 Procedures for Explosives Areas**

In this section, procedures for responding to fires in explosives areas and the hazard classification for each fire division are described. Signs and symbols associated with each fire division are shown in Appendix A.

### **4.1 Explosive Hazard Classifications and Fire Divisions**

#### **4.1.1 Explosive Hazard Classifications**

Every operation at LLNL and Site 300 involving explosives is conducted under the provisions of a safety procedure. Each safety procedure includes a hazard analysis of the operation and classification of the hazard. The type of explosives present roughly determines the hazard classification.

Hazard severities are classified as

- Class/Division 1.1 (mass explosion)
- Class/Division 1.2 (non-mass explosion, fragment producing)

- Class/Division 1.3 (mass fire, minor blast, or fragment)
- Class/Division 1.4 (moderate fire, no blast)
- Class/Division 1.5 (very insensitive explosives/blasting agents)
- Class/Division 1.6 (extremely insensitive ammunition)

Appendix B gives a detailed description of each hazard class/division.

#### **4.1.2 Fire Divisions**

Fire Divisions 1–6 are synonymous with Class/Divisions 1.1–1.6, as described in the *DOE Explosives Safety Manual*. Fire Division 1 indicates the greatest hazard. The hazard decreases as the fire division numbers increase. Because of similar fire-fighting hazards, Fire Division 1 and 2 fire symbols and numbers are also used for Fire Divisions 5 and 6, respectively.

### **4.2 Placarding with Fire Division Symbols**

Chapter II, Section 22.1, of the *DOE Explosives Safety Manual* states that facilities and areas containing explosives must have placards that warn individuals of potential hazards from explosives, and that those placards must provide information about dealing with emergencies.

Facilities containing explosives at the Livermore site and Site 300 are placarded with distinctive fire division symbols (shown in Appendix A) to warn emergency response personnel of potential hazards. These symbols enable fire fighters to quickly recognize the potential hazards of explosives they are approaching. The placard's shape, hazard, and class/division of explosives given in Table 1 are based on the classification system in DOD 6055.9 STD.

The fire division symbol that applies to the most hazardous material present shall be posted on or near all buildings and areas containing explosives. For additional precaution, half-sized symbols may be used for interior rooms, magazines, laboratories, and lockers and safes. Exterior fire division symbols must be visible from all approaching roads. One fire division symbol posted on or near the door of an igloo-type magazine is normally adequate. Multiple magazines or cubicles should each have a fire division symbol with a separate full-sized symbol posted to reflect the overall hazard.

### **4.3 Emergency Response Plans**

Emergency Response Plans (“run cards”) contain relevant information on all hazards in a facility and specify the explosive hazard, setback and emergency withdrawal distances, and response procedures. The LLNL Fire Department shall be responsible for preparing Emergency Response Plans for explosives facilities at the Livermore site and Site 300.

**Table 1. Placard shapes, explosive hazard classification, and hazards for fire divisions.**

| <b>Fire division</b> | <b>Placard shape (symbol)</b> | <b>Hazard class/division</b> | <b>Hazard</b>                                 |
|----------------------|-------------------------------|------------------------------|---|
| <b>1</b>             | <b>Octagon (1)</b>            | <b>1.1, 1.5</b>              | <b>Mass explosion</b>                         |
| <b>2</b>             | <b>Cross (2)</b>              | <b>1.2, 1.6</b>              | <b>non-mass explosion, fragment producing</b> |
| <b>3</b>             | <b>Inverted triangle (3)</b>  | <b>1.3</b>                   | <b>Mass fire, minor blast, or fragment</b>    |
| <b>4</b>             | <b>Diamond (4)</b>            | <b>1.4</b>                   | <b>Moderate fire, no blast</b>                |

Whenever any safety procedure changes the status of an Emergency Response Plan, the area ES&H team shall notify the emergency dispatcher at Fire Station I for Livermore facilities and Fire Station II for Site 300 facilities. This notification must be made verbally at the time of the change, but must be followed by a copy of the revised safety procedure.

#### **4.3.1 Setback Distances**

The setback distances specified in Table 2 are the distances personnel initially withdraw to when an accident or fire involves a facility or vehicle and the Emergency Response Plan information is not available. These are also the minimum distances at which the command post may be initially setup. With approval of Hazards Control Explosives Safety, facility-specific setback distances may be reduced from those specified in Table 2 when facility design and construction protective features (e.g., blow-out panels, directed blast), earth berms, and natural terrain provide the necessary protection to personnel. Greater distances may be required depending on the nature and quantity of the explosives and the incident.

Following are recommended fire-response actions for setback distances that are based on the class/division and location (or quantity) of the explosives. The presence of other hazardous materials or conditions may require a more conservative approach than the actions listed here.

1. Personnel must be protected from fragments at setback distances less than 2500 ft for Class/Divisions 1.1 and 1.2 explosives.
2. The maximum debris throw range, if known, with a safety factor of 2 may be used to replace the minimum distances given in Table 2 for Site 300 facilities.

**Table 2. Minimum setback distances based on DOD 6055.9-STD. These distances were established to minimize exposure to blast fragments and overpressure from a detonation when facility-specific Emergency Response Plans are not available.**

| Facility/<br>equipment                     | Fire class/division        |                            |                           |                          |
|--|----------------------------|----------------------------|---------------------------|--------------------------|
|  | 1.1                        | 1.2                        | 1.3                       | 1.4                      |
| <b>Livermore Site</b>                      |                            |                            |                           |                          |
| <b>B191</b>                                | <b>25 ft<br/>(8 m)</b>     | <b>N/A</b>                 | <b>25 ft<br/>(8 m)</b>    | <b>25 ft<br/>(8 m)</b>   |
| <b>B222</b>                                | <b>50 ft<br/>(15 m)</b>    | <b>N/A</b>                 | <b>50 ft<br/>(15 m)</b>   | <b>N/A</b>               |
| <b>B341</b>                                | <b>50 ft<br/>(15 m)</b>    | <b>N/A</b>                 | <b>50 ft<br/>(15 m)</b>   | <b>50 ft<br/>(15 m)</b>  |
| <b>B344/345</b>                            | <b>150 ft<br/>(45 m)</b>   | <b>N/A</b>                 | <b>50 ft<br/>(15 m)</b>   | <b>50 ft<br/>(15 m)</b>  |
| <b>All other<br/>buildings</b>             | <b>100 ft<br/>(30 m)</b>   | <b>N/A</b>                 | <b>100 ft<br/>(30 m)</b>  | <b>100 ft<br/>(30 m)</b> |
| <b>All Site 300<br/>buildings</b>          | <b>1250 ft<br/>(381 m)</b> | <b>800 ft<br/>(244 m)</b>  | <b>300 ft<br/>(91 m)</b>  | <b>100 ft<br/>(30 m)</b> |
| <b>DOE explosives<br/>vehicles</b>         | <b>1250 ft<br/>(381 m)</b> | <b>800 ft<br/>(244 m)</b>  | <b>300 ft<br/>(91 m)</b>  | <b>100 ft<br/>(30 m)</b> |
| <b>Non-DOE<br/>explosives<br/>vehicles</b> | <b>2500 ft<br/>(762 m)</b> | <b>2500 ft<br/>(762 m)</b> | <b>600 ft<br/>(183 m)</b> | <b>300 ft<br/>(91 m)</b> |

#### **4.3.2 Emergency Withdrawal Distances**

The emergency withdrawal distances specified in Table 3 are the guideline distances that non-essential personnel (as determined by the Incident Commander) are to withdraw to when a fire involves or is supplying heat to explosive material or if the fire is so large that it cannot be extinguished with hand extinguishers.

The following recommended fire-response actions for emergency withdrawal distances are based on the class/division and location (or quantity) of the explosives. The presence of other hazardous materials or conditions may require a more conservative approach than the actions listed here.

1. Personnel must be protected from fragments and kept away from windows at emergency withdrawal distances less than 2500 ft for Class/Divisions 1.1 and 1.2 explosives.
2. When the facility is known to be capable of fully containing the blast and fragments produced by an accidental detonation or deflagration, the Incident Commander may reduce emergency withdrawal distances. The High Explosives Applications Facility (HEAF) meets this criterion.

**Table 3. Minimum emergency withdrawal distances based on DOD 6055.9-STD. These distances were established to minimize exposure to blast fragments and overpressure from a detonation.**

| Facility equipment              | Fire class/division |                    |                   |                  |
|---------------------------------|---------------------|--------------------|-------------------|------------------|
|                                 | 1.1                 | 1.2                | 1.3               | 1.4              |
| All Livermore facilities        | 100 ft<br>(30 m)    | N/A                | 100 ft<br>(30 m)  | 50 ft<br>(15 m)  |
| Site 300 facilities             | 2500 ft<br>(762 m)  | 2500 ft<br>(762 m) | 600 ft<br>(183 m) | 300 ft<br>(91 m) |
| All DOE vehicles                | 2500 ft<br>(762 m)  | 2500 ft<br>(762 m) | 600 ft<br>(183 m) | 300 ft<br>(91 m) |
| All non-DOE explosives vehicles | 4000 ft<br>(1220 m) | 2500 ft<br>(762 m) | 600 ft<br>(183 m) | 300 ft<br>(91 m) |

3. Structures or protected locations offering equivalent protection for the distances listed in Table 3 may be used in lieu of relocating personnel to other structures or locations with the specified withdrawal distance.
4. The maximum debris throw range, if known, with a safety factor of 2 may be used to replace the minimum distances specified in Table 3.

## 4.4 Emergency Response Procedures

### 4.4.1 Initial Actions

Fire fighters responding to a fire in an explosives area should bring the Emergency Response Plan, which contains relevant information on all hazards in the facility. Once at the scene, the fire fighters should

- Set up a command post at the specified setback distance, taking advantage of all possible cover.
- Observe the building for visible smoke or flames, if possible.
- Obtain all pertinent information about the status of explosives material in the facility from knowledgeable facility personnel. If the class/division or the amount of explosive material involved is different than originally assumed, adjust your response actions accordingly.
- Have personnel from the Protective Force Division help control the evacuation and seal off the area in accordance with the Emergency Response Plan.

Fire fighters shall not enter the facility unless instructed to do so by the Incident Commander. The Incident Commander is in charge of the Incident Command Post and is responsible for preventing loss of life or property and reducing the impact on the environment.

#### **4.4.2 Cooling-Off Period**

After all personnel are safe and accounted for, allow a cooling-off period before entering the facility. In general, the more uncertain the hazard, the longer this cooling-off period should be. If smoke or flames are visible, for example, allow at least one hour after the smoke or flames are no longer visible for cooling off. If the alarm occurred at night in an extremely hazardous area, it would be advisable to wait until the next morning to enter the facility.

#### **4.4.3 Re-entry**

*Team Members.* The re-entry team will normally consist of two persons, one of whom should be familiar with the facility and the explosives. While this person usually will be the building representative, another person (building coordinator or facility manager [or his/her designee]) may be assigned by the Incident Commander. The other person is usually the Fire Captain who is experienced in entry and rescue techniques.

NOTE: In the Laser Program, the building representative is referred to as the Building Safety Coordinator; and at Site 300, the Building Supervisor.

*Protective Equipment.* The re-entry team should be equipped with head and face protection, complete sets of flame-resistant clothing, and transceivers or other means of communication. Other necessary equipment may include keys to buildings, flashlights, extinguishers, binoculars, breathing apparatus, safety shoes, booties, and fire-fighting boots. The Fire Department will provide respiratory protective equipment, as needed. The Incident Commander will determine at the scene what protective equipment is required.

WARNING: The use of radio transmitters may cause electroexplosive devices (e.g., squibs or blasting caps that are sensitive to radio-frequency fields) to activate. If this is a possibility, do not use portable transmitters closer than 15 ft (5 m) of such devices (from the Institute of Explosives Pamphlet 20, "Radio Frequency Energy").

*Re-entry Procedure.* The re-entry team must be given a briefing on all relevant facts, including the safest route for approaching the facility. The team should not approach the building from the frangible side. The Fire Department Captain should cautiously approach the building while the other team member keeps him/her in constant view. The Captain should first approach and read the fire alarm annunciator panel to determine which section of the building is alarmed and relay this information to the Incident Commander. As the lead, the Captain should feel doors for heat before opening them cautiously.

During the approach, the team should look for signs of fire or heat, such as scorched places, bulging structural members, smoke, and discoloration. If any unexpected, dangerous condition is found, the team should move to a safe location and delay the re-entry. The team should relay all observations and details of the re-entry to the Incident Commander using a dedicated radio frequency. The Incident Commander will direct the next appropriate actions to protect the facility or continue the stand-off based on information received to this point.



Upon completing all actions necessary to eliminate the emergency, control of the facility involved will be transferred to the building representative and the Hazards Control ES&H team for an incident analysis and any reporting that should be required.

## **5.0 Responsibilities**

### **5.1 Hazards Control**

#### **5.1.1 Fire Department**

The LLNL Fire Department is responsible for

- Preparing appropriate emergency response plans for explosives facilities at the Livermore site and Site 300.
- Responding to fires with an on-scene Incident Commander and fire fighters.

#### **5.1.2 ES&H Teams**

The ES&H team is responsible for notifying the Emergency Management Division (LLNL Fire Department) for Livermore and Site 300 facilities whenever any OSP changes the status of an Emergency Response Plan.

### **5.2 Facility/Program Personnel**

Facility or program personnel shall

- Ensure that the appropriate fire division placard is posted on facilities and areas containing explosives.
- Follow the orders of the Incident Commander and Protective Force Division personnel.
- Accompany a Fire Department member on the re-entry team when requested to do so.

## **6.0 LLNL Contacts**

For further information about this supplement, contact the following as necessary:

- Emergency Management Division (LLNL Fire Department) (ext. 2-5194)
- ES&H teams
- Hazards Control Technical Support and Policy Development (TSPD) Division, Explosives Safety (ext. 2-5128)



## Appendix A

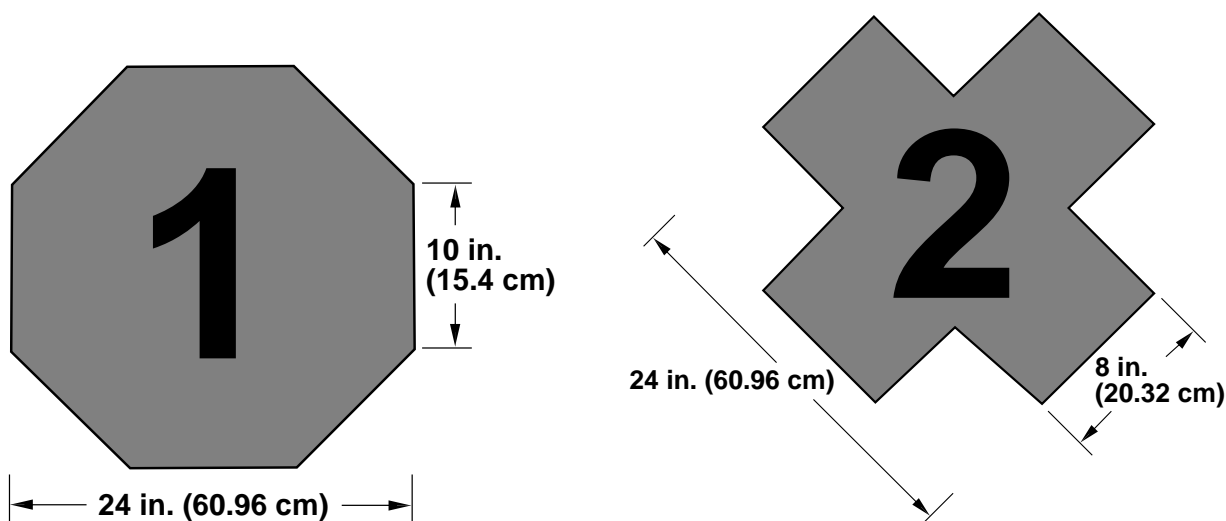
### Explosives Hazard Warning Placards (Fire Division Symbols)

#### A.1 General

The four distinctive fire symbols shown in this appendix are based on DOD 6055.9 STD (Ammunition and Explosives Safety Standards) and are used to alert fire fighters to the DOE Class 1 explosives hazards (Divisions 1–6). Fire Division 1 symbol indicates the greatest hazard. The hazard decreases as the fire division numbers increase. Fire Divisions 5 and 6 are not normally used at LLNL; these refer to explosion hazards from less sensitive substances and extremely insensitive articles, respectively.

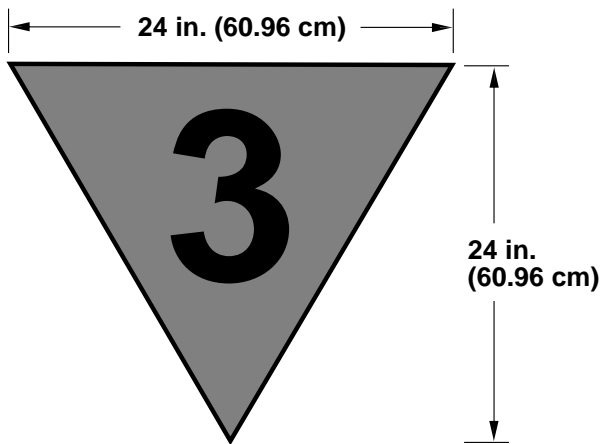
#### A.2 Colors and Dimensions

The background color of each placard is orange (#12246, Fed. Std. 595A), and the numbers are black (#17038, Fed. Std. 595A) and are 10 in. × 2 in. (25.4 cm × 5.08 cm).

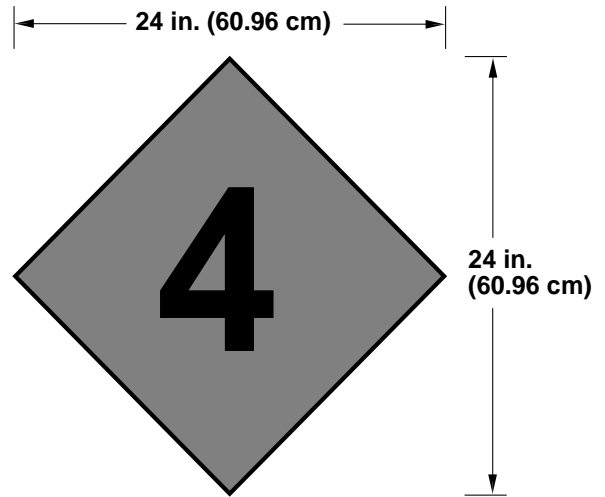


Fire Division 1 (Mass explosion) or  
Fire Division 5 symbol (Mass explosion/  
blasting agents)  
24 in. (60.96 cm) (NSN-7690-01- 082-6289)  
12 in. (30.48 cm) (NSN-7690-01- 081-9581)

Fire Division 2 (Explosion with fragment  
hazard) or Fire Division 6 symbol  
(Nonmass explosion/EIDS article)  
24 in. (60.96 cm) (NSN-7690-01- 082-0289)  
12 in. (30.48 cm) (NSN-7690-01- 087-7340)



**Fire Division 3 symbol (Mass fire)**  
**24 in. (60.96 cm) (NSN-7690-081-9583)**  
**12 in. (30.48 cm) (NSN-7690-081-9582)**



**Fire Division 4 (Moderate fire/no blast)**  
**symbol**  
**24 in. (60.96 cm) (NSN-7690-01- 082-6709)**  
**12 in. (30.48 cm) (NSN-7690-01- 081-9584)**

## Appendix B

### Class/Division Definitions

**Class/Division 1.1 (Mass explosion).** Entire quantities of items in this division can detonate almost instantaneously. Some examples include bulk explosives, some propellants, mines, bombs, demolition charges, torpedo and missile warheads, rockets, palletized projectiles loaded with TNT or Composition B, 8-in. and larger high-capacity projectiles loaded with Explosive D, mass-detonating ammunition components, blasting caps, unpackaged detonators, demolition materials, mines, LX and PBX explosives, detasheet, black powder, smokeless powder, unpackaged squibs, nitroglycerine, candle pads, mirror pads, shape charges, and dynamite.

**Class/Division 1.2 (Non-mass explosion, fragment producing).** Items in this division do not mass detonate when a single item or package in a stack is initiated. Explosions involving these items result in their burning and exploding progressively, a few at a time—projecting fragments, firebrands, and unexploded items from the explosion site. Blast effects are limited to the immediate vicinity, but fragments may be projected out to 1800 ft. Most fragments produced by incidents in this division will fall within one of four specified distances: 400, 800, 1200, or 1800 ft. Examples include artillery projectiles, rocket motor igniters, and some primers.

**Class/Division 1.3 (Mass fire, minor blast, or fragment).** Items in this division burn vigorously (deflagrate) with little or no chance of being extinguished in storage. Explosions will normally be confined to pressure ruptures of containers and will not produce propagating shock waves or damaging blast over pressure beyond the magazine distance. A severe hazard of the spread of fire may result from burning container materials, propellant, or other flaming debris tossed about by the force of the pressure ruptures. Examples include some rocket motor propellants, most gun propellants, document destroyers, flares, markers, and signal smokes.

**Class/Division 1.4 (Moderate fire, no blast).** Items in this division present a fire hazard with no blast hazard and virtually no fragmentation or toxic hazard beyond the fire clearance ordinarily specified for high-risk materials. Examples include most small arm ammunition, DOT-packaged detonators, squibs, primers, explosive bolts, and valves. Some articles such as detonators, primers, and squibs revert to Division 1.1 or 1.2 when removed from the DOT packaging.

**Class/Division 1.5 (Very insensitive explosives/blasting agents).** These explosive substances are also known as Extremely Insensitive Detonating Substances (EIDS) and basically equate to the former explosives category of Insensitive High Explosives (IHE). This division encompasses substances that, although mass detonating, are so insensitive that there is negligible probability of

initiation of transition from burning to detonation in storage. LLNL does not currently have any explosives that meet the criteria for this classification. Commercial blasting agents such as ANFO and ammonium nitrate emulsions also fall in this division.

**Class/Division 1.6 (Extremely insensitive ammunition).** This division includes ammunition that contains EIDS. It has been demonstrated through test results that the mass and confinement effects of the ammunition are negligible on the probability of initiation of transition from burning to detonation of the EIDS in transport or storage. Such ammunition, when intentionally initiated, is capable of transferring detonation to another (i.e., propagating). LLNL does not currently have any explosive articles that meet the criteria for this classification.